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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/709,054	04/09/2004	Shao-Kang Chang	NTCP0019USA	3053
27765	7590	01/11/2006	EXAMINER	
NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION P.O. BOX 506 MERRIFIELD, VA 22116			CHEN, ERIC BRICE	
			ART UNIT	PAPER NUMBER
			1765	

DATE MAILED: 01/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	10/709,054	CHANG ET AL.	
	Examiner	Art Unit	
	Eric B. Chen	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 04 April 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☒ Claim(s) 1-4, 7 and 8 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>7/7/04</u> . | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### ***Priority***

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

### ***Specification***

2. The disclosure is objected to because of the following informalities: to clarify the Specification, it is recommend that "NTC-1" be replaced with -- first --, "NTC-2" be replaced with -- second --, and "solution "A"" be replaced with -- subcomponent -- (i.e., a *first* solution, a *second* solution, a *subcomponent*). Otherwise, the terms could be confused with registered trademarks or technology specific acronyms. Appropriate correction is required.

### ***Claim Objections***

3. Claims 1-3, 7, and 8 are objected to because of the following informalities: to add clarity, it is recommend that "NTC-1" be replaced with -- first --, "NTC-2" be replaced with -- second --, and "solution "A"" be replaced with -- subcomponent -- (i.e., a *first solution* prepared by mixing a *subcomponent* comprising...). Appropriate correction is required.
4. Claim 4 is objected to because of the following informalities: to add clarity, it is recommended that "HAc" be replaced with -- acetic acid --.

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1, 4, 5, and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by Saito et al. (U.S. Patent No. 4,787,997).

7. As to claim 1, Saito discloses an etchant composition (column 1, lines 7-12) comprising: an NTC-1 solution prepared by mixing solution “A” comprising an organic acid, HF, and nitric acid with a 49% HF solution (column 3, lines 15-19, lines 25-29); and an NTC-2 solution comprising metal ions (copper nitrate in solution) (column 3, line 31) and a strong oxidant (nitric acid) (column 3, line 17; column 2, lines 63-65); wherein said NTC-1 solution and said NTC-2 solution are mixed together at a specific volume ratio (column 3, lines 15-19, lines 25-31). It should be noted that “HF” is interpreted as hydrofluoric acid solution, regardless of concentration.

8. As to claim 4, Saito discloses that said organic acid comprises HAc (acetic acid) (column 3, line 15).

9. As to claim 5, Saito discloses that said metal ions comprise copper ions (copper nitrate in solution) (column 3, line 19).

10. As to claim 8, Saito discloses that the specific volume ratio of said NTC-1 solution to said NTC-2 solution is in a range of 1:1 to 1:5 (column 3, lines 15-19, lines

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26-30). Applicants claim neither a specific organic acid/HF/nitric acid/49% HF solution volume ratio for NTC-1, nor a specific metal ions/strong oxidant volume ratio for NTC-2. Thus a specific volume ratio of 1:1 to 1:5 for NTC-1 to NTC-2 encompasses any mixture of organic acid, HF, nitric acid, and 49% HF solution, metal ions, and strong oxidant.

***Claim Rejections - 35 USC § 103***

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saito.

13. As to claim 2, Saito does not expressly disclose that the volume ratio of said organic acid, HF, and nitric acid in the solution "A" is in a range of 1:1:4 to 1:1:25. However, Saito teaches that etching rate and surface roughness can be controlled by the concentration of nitric acid (column 2, lines 63-65). Moreover, Saito teaches, by disclosing that the concentration of nitric acid may be varied (column 3, line 18), that changing the concentration of the nitric acid appears to reflect a result-effective variable which can be optimized. See MPEP § 2144.05 (II). Nitric acid concentration can be varied according, depending on the desired outcome a specified etching step.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a volume ratio of said organic acid, HF, and nitric acid in the

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solution "A" is in a range of 1:1:4 to 1:1:25. One who is skilled in the art would be motivated to optimize through routine experimentation of nitric acid concentrations. See MPEP § 2144.05 (II).

14. As to claim 3, Saito does not expressly disclose that said solution "A" and said 49% HF solution are mixed together at a volume ratio in a range of 2:1 to 5:1. However, Saito teaches that etching rate and surface roughness can be controlled by the concentration of HF (column 2, lines 56-62). Moreover, Saito teaches, by disclosing that the concentration of HF may be varied (column 3, line 16), that changing the concentration of the nitric acid appears to reflect a result-effective variable which can be optimized. See MPEP § 2144.05 (II). HF concentration can be varied according, depending on the desired outcome a specified etching step. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, such that said solution "A" and said 49% HF solution are mixed together at a volume ratio in a range of 2:1 to 5:1. One who is skilled in the art would be motivated to optimize through routine experimentation of HF concentrations. See MPEP § 2144.05 (II).

### ***Claim Rejections - 35 USC § 103***

15. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saito, in view of Kern, *Handbook of Semiconductor Wafer Cleaning Technology*, Noyes Publications (1993).

16. As to claim 6, Saito does not expressly disclose that said strong oxidant comprises hydrogen peroxide, ozone, and sulfuric acid. Kern teaches that hydrogen

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peroxide solutions are commonly used method to oxidize the surface of a silicon wafer (pages 123, 125-126). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use hydrogen peroxide as a strong oxidant. One who is skilled in the art would be motivated to use a commonly used oxidant, known to be effective at forming oxides on silicon.

17. As to claim 7, Saito does not expressly disclose said NTC-2 solution comprises 90% hydrogen peroxide solution and copper nitrate solution with a concentration of 0.005M to 0.02M, and the volume ratio of hydrogen peroxide solution to copper nitrate solution is in a range of 2:1 to 5:1.

18. However, Saito teaches that etching rate and surface roughness can be controlled by the concentration of oxidizing agent (nitric acid) (column 2, lines 63-65). Moreover, Saito teaches, by disclosing that the concentration of oxidizing agent may be varied (column 3, line 18), that changing the concentration of the oxidizing agent appears to reflect a result-effective variable which can be optimized. See MPEP § 2144.05 (II). Oxidizing agent concentration can be varied according, depending on the desired outcome a specified etching step. Kern further teaches that hydrogen peroxide solutions are commonly used method to oxidize the surface of a silicon wafer (pages 123, 125-126). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use 90% hydrogen peroxide solution, and the volume ratio of hydrogen peroxide solution to copper nitrate solution is in a range of 2:1 to 5:1. One who is skilled in the art would be motivated to optimize through routine experimentation of hydrogen peroxide concentrations. See MPEP § 2144.05 (II).



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Furthermore, one who is skilled in the art would be motivated to use a commonly used oxidant, such as hydrogen peroxide, known to be effective at forming oxides on silicon.

19. Saito's etching solution is used to evaluate crystal defects on silicon wafers (column 1, lines 7-12). Furthermore, Saito teaches that copper nitrate has the effect of increasing the selectivity of the etching solution to certain defects (column 3, lines 5-7). Moreover, Saito teaches, by disclosing that the concentration of copper nitrate may be varied (column 3, line 7-11), that changing the concentration of the copper nitrate appears to reflect a result-effective variable which can be optimized. See MPEP § 2144.05 (II). Copper nitrate concentration can be varied according, depending on the desired outcome a specified etching step and the type of defect to be measured. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a copper nitrate solution with a concentration of 0.005M to 0.02M, and the volume ratio of hydrogen peroxide solution to copper nitrate solution is in a range of 2:1 to 5:1. One who is skilled in the art would be motivated to optimize through routine experimentation of copper nitrate concentrations. See MPEP § 2144.05 (II).

### ***Conclusion***

20. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Brown (U.S. Patent No. 6,275,293) discloses etching silicon with acetic acid, HF, nitric acid, and copper nitrate.



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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B. Chen whose telephone number is (571) 272-2947. The examiner can normally be reached on Monday through Friday, 8AM to 4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G. Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

EBC  
Jan. 5, 2006



**NADINE G. NORTON**  
**SUPERVISORY PATENT EXAMINER**  
